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Correlation between Running Surface Types and Risk of Iliotibial Syndrome

Rizki Setiawan*, Farid Rahman

Department Physiotherapy, Faculty of Health Science, Universitas Muhammadiyah Surakarta, Indonesia

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Abstract

Running is the most performed sport by people, thus it is important to pay attention to the running surface because it can be a factor of injuries experienced by runners. Running on a road runner track is preferred because it can reduce injuries by 32.4%. A study from the Vancouver Running Clinic, the frequency of experiencing Iliotibial Band Syndrome (ITBS) was 6.8% for men and 9.8% for women. This research was aimed to determine the relationship between the type of running surface and Iliotibial Band Syndrome (ITBS) injuries. This research is a correlational study using cross sectional approach. In this research, the non-probability sampling and incidental sampling techniques were used. This research involved 80 runners in the Special Region of Yogyakarta and Magelang City as subjects. The data collection instruments for this research included the Ober test for ITBS and a questionnaire for respondent history. Analysis of data regarding the relationship between the type of running surface and the incidence of Iliotibial Band Syndrome found no relationship. It shows that the type of running surface does not affect the incidence of Iliotibial Band Syndrome (ITBS) in runners. It is expected that this research can become a baseline or foundation for developing prevention of Iliotibial Band Syndrome.

INTRODUCTION

Sports play a significant role in people's lives, particularly in maintaining and enhancing their health (Saputra & Jasman, 2018). According to Google, badminton, cycling, and running are the three most popular sports (Mulya et al., 2022). In the last four years, running has become a popular sport and many people incorporate it into their daily routines to live a healthy lifestyle (N. F. Sari et al., 2020).

Running is the most prevalent physical activity among exercises enjoyed by the general public. Although running on any track is acceptable, it is essential to pay attention to the track surface. Road running trails are frequently chosen by runners because they pose a 32.4% reduced risk of injury. The running track uneven surface can be a major cause of injury (N. F. Sari et al., 2020).

Iliotibial band syndrome, also known as ITBS, is an ailment caused by overuse of connective tissue bands along the outer thigh and knee (McKay et al., 2020). ITBS is the most prevalent cause of running-related lateral knee pain. ITBS is influenced by strain and strain rate, kinematic abnormalities in the frontal and transverse planes, and atrophy in the lateral and posterior hip muscles. In a four-year prospective study on 400 female runners from the University of Delaware, ITBS was found to be the second most prevalent running injury and the primary cause of lateral knee discomfort, with a prevalence of 16%. (Baker & Fredericson, 2016) discovered a 6.8% male prevalence and a 9.8% female prevalence of ITBS at the Vancouver running clinic.

According to the explanation regarding the urgency and the incidence of Iliotibial Band Syndrome, this research is relevant to the needs of society, especially running athletes. Through this research, researchers were trying to explain and prove the relationship between the type of running surface and the incidence of Iliotibial Band Syndrome.

Individuals with ITBS typically experience pain on the lateral side of the knee, particularly when sprinting, walking, or jumping. Pain typically subsides with slumber. It can impede sports and daily activities if left unchecked (Malfira & Hilmy, 2020). A history of previous study on injuries showed that age (34 years), iliotibial band tension, interval training, improper use of

shoes, running track surface, long distance running, lack of recovery, downhill running, difference in leg length, increased knee flexion angle during the heel flexion phase, weakness of the knee extensors, knee flexors, and hip abductors are associated with the occurrence of ITBS (McKay et al., 2020). ITBS injuries are also caused by a lack of stretching exercises (Arumugam & Govindharaj, 2018). ITBS risk factors can also include exercise programs, sports equipment, and exercise media surfaces (Ismunandar, 2020).

The most prevalent types of running surfaces are road runner surfaces and trail runner surfaces. These two surface varieties have distinct structures. The road runner track surface is composed of solid asphalt, whereas the trail runner track surface structure is less stable due to friction of the particulates of the trail running track structure, causing runners to move slower (N. F. Sari et al., 2020).

The biomechanical approach to running focuses primarily on athletes, but it can also investigate the behaviour of inanimate objects such as footwear and running surfaces (Rahadian, 2019). It also demonstrates that there are distinctions in the injury risk associated with each running surface type. Long-distance running on a running track surface carries a 67.6% greater risk of severe injury than road running, which carries a 32.8% greater risk of serious injury. The dense structure of small stone particles on the surface of the trail running track causes the small stone particles to travel along with the footrests, increasing the risk of foot injury (N. F. Sari et al., 2020). The research gap found in previous studies is that there has been no in-depth discussion of the relationship between the type of running surface and the incidence of Iliotibial band syndrome (ITBS).

The difference between this research and previous research laid in the subject being addressed and the results of the research process. On the basis of this explanation, researchers aimed to conduct additional observations regarding the correlation between the type of running surface and the incidence of Iliotibial Band Syndrome (ITBS).

METHODS

This study employed a correlational study with a cross-sectional design. This study aimed to determine

the relationship between two variables, specifically the relationship between running surface type and the incidence of Iliotibial Band Syndrome (ITBS). This investigation had been approved by the investigation Health Research Ethics Commission (KEPK) of the Faculty of Medicine at the University of Muhammadiyah Surakarta. A Letter of Ethical Eligibility had been issued with the number 4567/B.2/KEPK-FKUMS/XI/2022. There were two variables in this research. The incidence of Iliotibial Band Syndrome (ITBS) among runners was the dependent variable, while the type of running surface was the independent variable.

The research was conducted in September - November 2022 using an incidental approach. Any person the researcher met unexpectedly or accidentally could be involved as a sample when they were suitable as the data source. This sampling technique is known as incidental sampling (Sugiyono, 2015). To determine the status of iliotibial band tension and to differentiate iliotibial band syndrome from other common causes of lateral knee pain, iliotibial band syndrome was measured using Ober's test and Noble test instruments.

Participants

Runners who were members of the running community in the Special Region of Yogyakarta and the running community in Magelang City, Central Java, participated in this study. The total number of respondents gathered was 80. The research data collection was carried out on 12 – 13 November 2022.

Sampling Procedures

The sampling method used was the non-probability sampling, specifically the incidental sampling method. The researchers used this method because, random sampling is a sampling strategy based on chance, while incidental sampling is a sampling technique in which researchers meet by chance and involve them as a sample if they meet the requirements as a data source. Researchers took samples using incidental sampling techniques. The population involved 80 runners. The total sample also included 80 respondents. The inclusion criteria for this study were runners who were willing to serve as a research sample and who regularly participated in running sports. In contrast, individuals who refused to be a part of the research were excluded. The sampling technique used by researchers was random selection or also known as random choice.

Data collection techniques are methods for gathering information for research. Data collection procedures require purposeful and methodical actions to collect accurate and trustworthy data. In this study, data were collected by disseminating questionnaires via a Google form and by administering special tests pertaining to Iliotibial Band Syndrome (ITBS). Measuring tools or particular assessments of ITBS included the Ober's test and the Noble test (Arisady, 2019).

Materials and Apparatus

Considering the variables of this study, namely the independent variable and the dependent variable, the following definitions can be made:

1. Type of Running Surface. In this investigation, the type of running surface was the independent variable. Two types of running surfaces were distinguished: road runners and trail runners. Trail runners are a type of running surface on hilly and uneven roads (Sari et al., 2023). Road runners are a type of running surface on asphalt motorways with a solid and hard surface structure. A questionnaire to analyze the data regarding the type of running surface commonly utilized by Runners in Yogyakarta and Magelang City was used.
2. Iliotibial Band Syndrome (ITBS) Incident. In this investigation, the incidence of Iliotibial Band Syndrome (ITBS) served as the dependent variable. To determine the diagnosis or underlying cause of a problem in order to measure the incidence of Iliotibial Band Syndrome (ITBS), a special examination was conducted. The following unique checks were employed:
 - a. The Ober's Test. The purpose of the Ober's Test is to detect contractures or rigidity in the Tensor fascia latae muscle (Arisady, 2019). The Ober's test is sensitive if the upper limb remains suspended in the air and does not descend. The validity and reliability of the Ober's test range between 0.85 and 0.94, so the reproducibility of the Ober's test and the Modified Ober's test is estimated to be acceptable or excellent (Kesminas et al., 2019).
 - b. The Noble Test. This distinguishes Iliotibial Band Syndrome (ITBS) from other common causes of lateral knee discomfort (Ronggeman, 2022). For the Noble test to be sensitive, the iliotibial tract must be flexed 30 degrees while

maximal pressure is applied. When the Noble test is positive, it can be caused by muscle contracture or the iliotibial tract, inflammation of the associated iliotibial band or bursa, or inflammation of the lateral femoral condyle.

Procedures

During the process of the study, a number of procedures were executed, including observations of the running community in the Special Region of Yogyakarta as the initial step. This observation aimed to assess the field condition and collect preliminary data on the relationship between the type of running surface and the incidence of Iliotibial Band Syndrome (ITBS). During this observation procedure, each respondent who met the inclusion criteria was required to complete an Informed Consent (IC) form as an approval form for the collected data. The observation phase was followed by data processing to determine preliminary results and identify any technical errors that might impact the findings.

The second stage was the process of data collection in Magelang City. Researchers sought participants who met the inclusion criteria. Additionally, respondents were required to complete an Informed Consent (IC) form and a questionnaire regarding the relationship between the varieties of running surfaces and the incidence of Iliotibial Band Syndrome (ITBS). This questionnaire was used to reveal the most common running surface utilized by athletes as well as the incidence of Iliotibial Band Syndrome (ITBS). Following the completion of the questionnaire, the respondent was given a special examination or test to learn more about the complaints that the respondent had. The tests included the Ober's test and the Noble's test. The final phase of the investigation was processing the data collected from the running community in Magelang.

During the research process, Informed Consent (IC) had been screened to ensure that it was feasible and could be used as intended. Informed Consent (IC) refers to the willingness of patients or prospective research subjects to accept experimental measures or harmful interventions after receiving adequate and pertinent information about the therapy they will receive.

Data Analysis

Data analysis is one of the most crucial phases of research. After data acquisition, data analysis is the subsequent step. The approach to data analysis differs depending on the case and the research methodology employed. The data analysis in this study was administered to explain and prove the relationship between the type of running surface and the incidence of Iliotibial Band Syndrome.

Univariate Analysis

The objective of univariate analysis is to explain or define the characteristics of each study variable. The descriptive statistics used to characterize the parameters of each variable were conducted to present the data, including the mean, median, mode, and dispersion values (variance, standard deviation, range). In addition, the total score was measured to contribute to characteristics of the data.

Bivariate Analysis

Two variables were subjected to the bivariate analysis to determine differences. Because the magnitude of the data was normal, the researcher employed the Chi-Square test. The chi-square test is used to determine the relationship between two nominal variables, as well as the severity of the relationship.

RESULT

The results of this study describe the relationship between the type of running surface and the incidence of Iliotibial Band Syndrome (ITBS) in runners in the running community of Yogyakarta Special Region and Magelang City, Central Java. A total of 80 respondents had been involved through a long process and had met the research inclusion criteria.

Based on Table 1, in the characteristic section of the respondent profile, the number of the respondent was 80. The percentage of the road runner variable was 56% and N 51. The variable of trail runner assigned a value of 32% and N 29. The incidence of Iliotibial Band Syndrome (ITBS) was also affected by running distance, 31% and N 28 for distances < 5 km and 57% and N 52 for distances >5 km. Regarding the Iliotibial Band Syndrome (ITBS), there were two types of incidences, namely positive negative right and positive neg

Table 1. Data Characteristics

	%	N	Mean ± STDEV	Median ± STDEV	Mode ± STDEV
Profile of Respondents					
Age	-	80			
Road Runners	56%	51			
Trail Runners	32%	29			
<5km	31%	28			
>5km	57%	52			
Right Positive ITBS	40%	32			
Right Negative ITBS	60%	48			
Left Positive ITBS	46%	37			
Left Negative ITBS	53%	43			
Amount %/N	100	80			
Angle Magnitude Fasciae Latae Category					
Right Fascia Latae angle		80	30.21 ± 7.47	31.00 ± 7.47	32 ± 7.47
Left Fascia Latae angle		80	28.92 ± 7.24	29.00 ± 7.24	28 ± 7.24
Flexibility Category					
Right Hamstring Flexibility		80	94.73 ± 13.73	95 ± 13.73	90 ± 13.73
Left Hamstring Flexibility		80	94.18 ± 18.44	95 ± 18.44	80 ± 18.44
Abductor Strength Category					
Right Abductor Strength		80	189.93 ± 63.22	200.00 ± 63.22	200.00 ± 63.22
Left Abductor Strength		80	195.06 ± 59.46	200.00 ± 59.46	200.00 ± 59.46

Source: Primary Data, 2022

Table 2. Correlation Test (Chi-Square Test) CI = 95%

Relationship independent variable - dependent variable	N	Asymp Sig (2-sided)	Conclusion
Running surface - ITBS(R)	80	0.448	H ₀ Accepted
Running surface - ITBS (L)	80	0.111	H ₀ Accepted

Source: Primary Data, 2022

ative left. Negative right gained a value of 60% and N 48, while positive right obtained value of 40% and N 32. Positive left got a value of 46% and N 37 and negative left gained 53% and N 43.

Moreover, Table 1 shows the analysis results of Magnitude Fascia Latae Angle Category. The mean value for the Right Fascia Latae Angle was 30.21, the median value was 31.00, and the mode value was 32. In contrast, the Left Fascia Latae Angle had a mean value of 28.92, a median value of 29.00, and a mode value of 28. For the Flexibility category, Right Hamstring Flexibility had an mean value of 94.73, a median value of 95, and a mode value of 90. Meanwhile, the mean value for Left Hamstring Flexibility was 94.18, the median value was 95, and the mode value was 80. The final category was the Abductor Strength Category, where the mean value for Right Abductor Strength was 189.93, the median value was 200.00, and the mode

value was 200.00. Left Abductor Flexibility, on the other hand, obtained a mean value of 195.06, a median value of 200.00, and a mode value of 200.00.

Table 2. presents the results of the Relationship Test (Chi-Square Test). The Running Surface-ITBS (R) variable with N = 80 and a confidence interval of 95% gained Asymp Sig (2-sided) value of 0.448. In contrast, the Asymp Sig value for the running surface-ITBS (L) variable with N 80 was 0.111. Examining the "Chi-Square Test" table from the results of SPSS data processing can provide guidelines or a foundation for decision making. If Asimp. Sig. (2 sides) > 0.05, H₀ is accepted and H_a is rejected (Irawati et al., 2021). It concludes that H₀ was accepted.

DISCUSSION

Iliotibial band syndrome (ITBS) injuries can be caused by a number of factors, including the type of running surface. Other factors might have a greater impact on ITBS injuries and must be considered. In Indonesia, a lack of warm-up frequently results in two categories of sports-related injuries: acute injuries and overuse syndromes, such as iliotibial band syndrome (ITBS) injuries (Pratomo & Gumantan, 2021).

Iliotibial Band Syndrome (ITBS) was not signifi-

cantly associated with the running track surface, according to the findings of this study. The correlation test conducted in this study yielded values of Sig 0.448 on the right limb and Sig 0.111 on the left leg ($p > 0.05$), indicating that the null hypothesis (H_0) is accepted.

The characteristics of the respondents showed that the road runner variable gained a percentage value of 56% with a frequency of 51. Meanwhile, the trail runner variable got a percentage value of 32% with a frequency of 29. The Incidence of Iliotibial Band Syndrome (ITBS) was divided into two, namely positive negative right and positive negative left. The positive right obtained a percentage value of 40% with a frequency of 32, while negative right got a percentage value of 60% with a frequency of 48. The positive left gained a percentage value of 46% with a frequency of 37, while negative left got a percentage value of 53% with a frequency of 43. The research data were also supported by factors influencing the occurrence of Iliotibial Band Syndrome (ITBS), including the Fascia Latae angle magnitude category, the hamstring flexibility category, and the abductor strength category.

Returning to the initial definition of Iliotibial Band Syndrome (ITBS) as a knee injury caused by inflammation in the distal part of the Iliotibial Band causing pain in the lateral part of the knee, there is a high risk of experiencing an Iliotibial Band Syndrome (ITBS) injury among athletes, especially those who run long distances (Zannuba et al., 2022). According to Zainab (2021), long distances and extended running times can cause friction and compression on the distal fat pads of the iliotibial band, resulting in the common occurrence of Iliotibial Band Syndrome (ITBS).

According to the findings of (Charles & Rodgers, 2020) study regarding the etiology of symptoms associated with Iliotibial Band Syndrome (ITBS), including anterior-posterior friction of the Iliotibial band on the lateral femoral condyle during knee flexion and extension activities, compression of the fat layer near the distal attachment of the Iliotibial band can cause overuse injury, so it can impact repetitive use syndrome. According to research conducted by Dwinagara (2021), professional runners sustain 2.5 injuries per 1000 hours, while novice runners sustain 33 injuries per 1000 hours. In addition, according to (Agustin, 2022), the prevalence of knee injuries is 22.38 percent, so it is believed that the high force applied to the knee joint, particularly

on the anterior-posterior friction of the iliotibial band during knee flexion and extension activities, increases the risk of developing iliotibial band syndrome injuries (ITBS).

At approximately 30 degrees of knee flexion, the anterior-posterior friction theory is founded on the formation of an impingement zone when the iliotibial band moves over the lateral femoral condyle. The iliotibial band bursa identifies a potential space between the iliotibial band and the tibio-femoral joint capsule, which contains the bursa and is inflamed from repeated friction of the iliotibial band over the lateral femoral condyle. The activity of protracted knee flexion and extension movements, during a prolonged pathophysiological process, correlates with the incidence of Iliotibial Band Syndrome (ITBS), according to (Charles & Rodgers, 2020).

Other factors that influence the cause of Iliotibial Band Syndrome (ITBS) include changes in the shape and length of the legs. This deformity in foot shape is commonly referred to as the O and X shape of the foot. In addition, leg length is one of the causes of Iliotibial Band Syndrome (ITBS) due to the fact that differences in leg length disrupt a runner equilibrium due to the incorrect strength of the dominant leg. The portion of the lower leg causes muscle tension (Al Vandy et al., 2022).

Giving athletes excessive exercise loads, such as leg presses and squats, can result in injuries, such as iliotibial band syndrome (ITBS) injuries. This occurs when the muscles or joints are overworked, leading to injury in runners (Zulman et al., 2019). Overreaching is also known as excessive, unplanned training with insufficient recovery periods (Setyaningrum, 2019). In addition to overtraining, failure to limber up can cause sports injuries, including in runners. When muscles are still cold and relaxed and are abruptly forced to run quickly, the risk of minor injuries or cramps during exercise increases (Mahfud & Gumantan, 2020).

The incidence of Iliotibial Band Syndrome (ITBS) can also produce pain in the lateral aspect of the knee, reducing the flexibility of the runner. In addition, flexibility is one of the factors that can impact a runner speed, so when flexibility is high, runners can move their joints in a greater range (Hasriani, 2021). Performing the proper warm-up can increase flexibility. Before running, it is essential to warm up for at least ten to fif-

teen minutes (Yolanda & Yuliandra, 2022). Before starting a fundamental training, an effective warming up is required to prevent injury because an ineffective warming up can also cause injury to athletes (Nurcahyo, 2015). To maximize the benefits, the warm-up must be performed effectively and with enjoyment (Andi et al., 2021).

Inappropriate running shoes are one of the external factors that can influence the incidence of Iliotibial Band Syndrome (ITBS). Many individuals are unaware of the impact of wearing shoes while jogging. This condition emphasizes the need for knowledge regarding running-specific athletic footwear. Because the plantar pedis is the first part of the foot affected by running, shoes with heel-to-toe drop should be considered. Heel-to-toe drop is the difference between the height of the heel and the height of the forefoot in running shoes; if this is not in accordance with industry standards, it can result in distress and injury in runners (Zhang et al., 2022). Many manufacturers of athletic footwear design their shoes with a heel drop of 4 mm, 6 mm, or 12 mm to provide athletes with the greatest possible comfort (Oktama et al., 2017).

CONCLUSION

Based on the results of the correlation test, it concludes that there was no correlation between the type of running surface and the incidence of Iliotibial Band Syndrome (ITBS). Another factor that correlates with the incidence of Iliotibial Band Syndrome (ITBS) is prolonged knee flexion and extension during a lengthy pathophysiological process. The limitations that become obstacles to this study were the measurement instruments that were less specific and less diverse with the incidence of Iliotibial Band Syndrome (ITBS) variable. Further research is expected to determine more specific independent variables, because the more specific and varied measurement instruments will make it easier for researchers in the measurement process. Hopefully, this research can help the development and progress of science.

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